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UNCLASSIFIED- INFORMATION ON SOVIET BLOC INTERNATIONAL GEOPHYSICAL COOPERATION - 1959

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INTERNATIONAL GEOPHYSICAL COOPERATION PROGRAM -- SOVIET-BLOC ACTIVITIES

Table of Contents

I. ROCKETS AND ARTIFICIAL EARTH SATELLITES

Official Announcements of Moon Rocket

The following is the text of the Tass announcement of the launching of the Moon rocket:

"On 12 September 1959, the second successful firing of a cosmic rocket occurred in the Soviet Union as part of the program for the investigation of cosmic space and preparation for interplanetary flights.

"The rocket was launched to investigate cosmic space during the flight to the Moon. A multistage rocket was used in the launching. The final stage of the rocket has exceeded the second cosmic velocity, 11.2 kilometers per second, and is moving towards the Moon. At 1500 hours Moscow time on 12 September, the Soviet cosmic rocket was 78,500 kilometers from the Earth and was located at this time above a point north of the island of New Guinea. The final stage of the cosmic rocket is a guided rocket weighing 1.511 kilograms without fuel. It is carrying a container with scientific radio apparatus. The container is in the form of a sphere, hermetically sealed, and filled with gas. There is provision for a system for the automatic control of temperature. After going into orbit, the container with the scientific equipment was separated from the final stage of the rocket.

"The following is to be accomplished with the aid of the second Soviet cosmic rocket: investigation of the magnetic field of the Earth and the magnetic field of the Moon, investigation of the radiation belts around the Earth, investigation of the intensity and variations in intensity of cosmic radiation, investigation of heavy nuclei in cosmic radiation, investigation of the gaseous component of interplanetary matter, and study of meteor particles.

"The total weight of the scientific and measuring equipment with power supply and container is 390.2 kilograms.

"The following transmitters were installed on the rocket to transmit to Earth all the scientific information, to measure the parameters of the motion, and to control the flight of the rocket.

"1. A radio transmitter operating on two frequencies, 20.003 and 19.997 megacycles emits signals in the form of a telegraph signal 0.8 to 1.5 seconds in length. It operates in such a way that during the pauses in the emission of the first frequency of 20.003 megacycles it transmits pulses on the second frequency of 19.997 megacycles.

"2. A transmitter operating on frequencies of 19.993 megacycles and 39.986 megacycles signals in the form of pulses of variable length from 0.2 to 0.8 seconds. The pulse repetition frequency is 1 ± 0.15 megacycles.

"3. A third transmitter operates on a frequency of 183.6 megacycles.

"There are pennants on the Cosmic Rocket bearing the symbol of the Soviet Union and the inscription, September 1959.

"For visual observation of the cosmic rocket, there is a special apparatus for creating a sodium cloud, an artificial comet. The artificial comet will be formed on 12 September at 21:39:42 Moscow time. It will be observed in the Aquarius constellation approximately on the line connecting the star of Alpha in the Constellation of the Eagle and Alpha in the constellation of the Southern Pisces. The equatorial coordinates of the comet will be equal to right ascension 20 hours 41 minutes, declination -7.2.

"The artificial comet will be observed and photographed by optical means (with light filters which separate out the spectral line of sodium) from the territory of Central Asia, the Caucasus, the Ukraine, Belorussia, the Central part of the European territory of the USSR, and also Europe, Africa, the countries of the Near East, India, and the western part of China.

"All the radio transmitters installed on the cosmic rocket are operating normally. Radio stations on the ground are receiving scientific information from the rocket.

"The parameters of the rocket's motion will be continuously measured with a special automatic measuring complex, the stations of which are situated at various points in the Soviet Union. Analysis of the measurements and determinations of the orbit are being conducted on high-speed electronic computers. Information on the motion of the cosmic rocket will be transmitted by all radio stations of the Soviet Union. According to preliminary data, the rocket is moving along a trajectory close to the calculated one. It is expected that the cosmic rocket will reach the Moon on 14 September at 00 hours 05 minutes Moscow time.

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"The successful firing of the second Soviet cosmic rocket is a new and important stage in man's investigation and conquest of the Cosmos. It broadens the prospects for international cooperation in conquering cosmic space and will help in further easing international tensions and strengthening the cause of peace." ("On the Launching of a Cosmic Rocket to the Moon by the Soviet Union," Tass announcement; Moscow, Pravda 13 Sept 59, p 1)

Tass Announcement Concerning the Motion of the Rocket After Launching

"The second Soviet cosmic rocket continues on its way to the Moon. At 1700 hours Moscow time, the rocket was 101,000 kilometers from the Earth and located at that time above the western part of the island of Sumatra. The rocket's radio transmitters which are operating on frequencies of 20.003 megacycles, 19.997 megacycles, 19.993 megacycles and 39.986 megacycles, and also on the frequency of 183.6 megacycles are operating steadily. The scientific and telemetering equipment installed on the rocket are functioning normally. The system of measuring stations and observation points around the Soviet Union are constantly receiving and recording radio signals. The ground radio stations are making measurements of the changing coordinates of the trajectory of the cosmic rocket on the basis of which the parameters of the rocket's orbit are determined in the computing center, and data on the target designation is computed. At 1900 hours, the cosmic rocket was located above the Indian Ocean over a point with coordinates 78 6 N and 5 4 S.

"Continuing its flight to the Moon, at 2200 hours Moscow time, the Cosmic Rocket was located above territory of South Africa (Tanganyika) and 152,000 kilometers from the Earth. All ground measuring stations are continuing their observations on the flight of the Cosmic Rocket and are recording the scientific information arriving from it.

"A preliminary analysis of the telemetric information shows that all the scientific equipment installed in the container of the second cosmic rocket is functioning normally. The temperature of the gas inside the container is being held within the limits of 20-25 degrees centigrade. The seal of the container is being maintained, at a given level, and scientific information continues to arrive at the computing center from recording points for analysis.

"At 21:39:42 Moscow time, the artificial comet formed by the cosmic rocket could be observed in the Aquarius Constellation with equatorial coordinates right ascension 20 hours 41 minutes and declination -7.2. At 2400 hours Moscow time on 12 September, the Cosmic Rocket was located above a point in the Atlantic Ocean with coordinates 4 7 E and 8 4 S.

"Radio observations on the rocket can be made from the countries of Southern Asia, Europe, Africa, South America, and Antarctica."
("The Motion of the Second Soviet Cosmic Rocket," Tass; Moscow, Pravda, 13 Sep 59, p 1)

Tass Announces Arrival of Rocket on the Moon

"Today, 14 September, at 00:02:24 Moscow time, the second soviet rocket reached the surface of the Moon. For the first time in history, a cosmic flight from the Earth to the surface of another celestial body was completed. To mark this outstanding event, there was deposited on the surface of the Moon a pennant with the symbol of the Soviet Union and the inscription 'Union of Soviet Socialist Republics, September 1959.' Measures were taken to insure the safety of the pennants on contact with the Moon. The program of scientific measurements is completed, the operation of the radio equipment installed in a container with scientific and measuring apparatus ceased at the moment of contact with the Moon. For the Soviet cosmic rocket to have reached the Moon is an outstanding success of science and technology. A new page has been opened in the investigation of cosmic space."
("The Pennants of the Soviet Union Are on the Moon!" Tass; Moscow, Pravda, 14 Sep 59, p 1)

Statements by Soviet Scientists on Moon Shot

Sterility of the Cosmic Rocket

Soviet scientists took all necessary measures to ensure the complete sterility of all the apparatus and all objects, which, together with cosmic rocket, fell on the Moon's surface, says N. D. Ierusalimskiy, Doctor of Biological Sciences and director of the Institute of Microbiology, Academy of Sciences USSR.

The outer surfaces of the rocket and container presented no danger in respect to the contamination of the lunar atmosphere, as their motion in airless space and in conditions of intense radiation would quickly destroy all microflora which might accidentally have

fallen on the outer portions of the rocket. As for the microorganisms which could have remained on the apparatus located inside the container and rocket, Ierusalimskiy says, special measures were required. These include the use of highly effective disinfectants, ultraviolet rays, ultrasonics, and others. ("Sterility of the Cosmic Rocket"; Moscow, Sovetskaya Aviatsiya, 15 Sep 59, p 2)

Problems of Interplanetary Flights

The outstanding achievements of Soviet science have theoretically made interplanetary travel within the limits of the solar system possible, says Prof B. Kukarkin, vice-president of the International Astronautical Union. The first celestial body to which man will undoubtedly aim for will be the Moon.

Interplanetary flights by man are already practically accomplished now, says Professor Kukarin, citing the examples of Soviet experiments in that field with animals. No man has yet flown in a cosmic rocket because, he says, there is no guarantee yet of safeguarding his health and safety. ("Problems of Interplanetary Flights," by B. Kukarkin; Moscow, Sovetskaya Aviatsiya, 15 Sep 59, pp 2-3)

Press Conference at Academy of Sciences

Soviet scientists are prepared to submit all information obtained during the flight of the second cosmic rocket to the scientists of other countries. So said Ye. K. Federov, corresponding Member of the Academy of Sciences USSR, at the press conference called by the academy and the State Committee for Cultural Relations Abroad, in connection with the latest Soviet Moon shot.

Academician L. I. Sedov emphasized that the successful Moon shot was possible because of the very precise and reliably operating automatic equipment. Radio data made it possible to determine very accurately the time and place of the container's encounter with the Moon. According to preliminary data, the impact occurred in the region of the Sea of Brightness. The accuracy was determined to be approximately 200-300 kilometers. ("Greatest Event of Modern Times;" Moscow, Sovetskaya Aviatsiya, 15 Sep 59, p 2)

Problem of Landing a Rocket on the Moon Solved

Prof G. I. Pokrovskiy, Doctor of Technical Sciences and Major General of the Engineering-Technical Services, says that the launching of the Soviet cosmic rocket is an indication of the considerable

progress of Soviet rocket engineering. Only a little more than 2 years have passed since the report of the successful testing of a Soviet ICBM and still less since the launching of the first Soviet artificial Earth satellite and the first artificial planet. During this period, says Pokrovskiy, the USSR has directed the most powerful rockets in the world into space and achieved considerably greater accuracy in their flight than the US.

Precise methods of automatic control ensuring the attainment of the Moon by the cosmic rocket and systems of automatic radio communication for transmitting complex scientific and technical information through cosmic space were developed. In addition, continues Pokrovskiy, the problem of an optical signal system was sloved with the aid of a sodium cloud, creating a bright flash of light in a determined wave length. The signal was made at a distance of about 100,000 kilometers. ("The Problem of Moon Landing a Rocket Is Solved," by G. I. Pokrovskiy; Moscow, Sovetskaya Aviatsiya, 15 Sep 59, p 2)

Optical Orientation Point Created for Cosmic Rocket

The second cosmic rocket carried apparatus similar to that of Mechta, the first Soviet cosmic rocket, for creating a sodium cloud in space. The cloud was formed at a predetermined moment, reached a diameter of about 1,000 kilometers, and lasted 5-6 minutes.

The artificial comet was observed in many of the southern Soviet observatories--Alma-Ata, Byurakan, Abastumani, Tbilisi, and Stalinabad. ("Optical Orientation Point on the Path Into the Cosmos," by V. Arsent'yev, Scientific Associate, State Astronomical Institute imeni Shternberg; Moscow, Sovetskaya Aviatsiya, 16 Sep 59, p 2)

Soviet Scientist on Space Flight and Recovery

"The most important result derived from the Layka experiment in Sputnik II was that lengthy flight in space can be satisfactorily endured by such a highly-developed organism as a dog," says B. Danilin, Candidate of Technical Sciences, in an article considering the possibility of man flying in space.

First of all, syas Danilin, it is necessary that man must painlessly endure the considerable G-stresses which arise during the precipitous increase in speed after the launching of a space ship. Experiments have shown that these forces of acceleration can be best

withstood in a back-to-chest direction (take-off), or even a chest-to-back direction (landing). Man can see, think, and accomplish specific movements with his fingers in the limits of the acceleration being imposed. If the acceleration is applied from foot to head or head to foot, then the ability to withstand it decreases sharply.

The ability to withstand acceleration increases sharply (more than doubles) if a man is immersed in water. However, says Danilin, such a measure is scarcely necessary since man also can, under corresponding conditions, endure the accelerations arising during the flight of a space craft without it.

After passing through the envelope of air surrounding the Earth, new dangers face the space ship in interplanetary space. Present studies have shown that in each cubic centimeter of interplanetary space, there are 1,000 particles. In addition, it is penetrated by streams of cosmic rays, corpuscles emitted by the Sun, and also by micrometeorites. The greatest danger for space flights according to Danilin, is from large meteor bodies capable of penetrating the hull of the craft. It is possible that it may be expedient to divide the cabin into several compartments, each having automatic pressure regulating controls. In this way, the damaged compartment can be quickly isolated, and with the use of special instruments each can be found and repaired later.

How great is this danger? Danilin says that experience has shown that after many months of flight in space not one of the Soviet artificial satellites were damaged or deflected from its orbit by the impact of a large meteor body. Thus, he says, the satellites established the fact that meteor matter exists in space in an extremely granulated condition, and, consequently, interplanetary flights are fully possible requiring only that the surface of space craft be covered by a special armor.

The greatest danger for the human organism, continues Danilin, is cosmic radiation. The launching of the artificial Earth satellites and the cosmic rocket made it possible for scientists to obtain information on the intensity of cosmic radiation at distances of over 100,000 kilometers for the first time.

Thus, it was discovered that an enormous amount of electrons exist around the Earth at a distance of about 50,000 kilometers. As a result of the bombardment of the metallic surface of space ships, these electrons can cause the appearance of X-rays, considerably intensifying the ionizing radiation. Since the energy of these electrons is comparatively small, a protective layer on the shell of the craft is sufficient for their absorption.

The intensity of cosmic rays at great distances from the Earth is so small (a total of two particles per second per cubic centimeter), that it cannot cause radiation illness in future cosmonauts.

However, says Danilin, explosive processes occur on the Sun from time to time, although very rarely, as a result of which powerful streams of cosmic rays arise and flight conditions during this time are least favorable.

For manned flights around the Earth lasting only several hours, Danilin considers an anti-G capsule equipped with a device for regenerating the air and for catapulting during the landing of the space craft as sufficient.

However, he says, even flights to the celestial body nearest us, the Moon, will take several days. It is not possible for a man to remain seated in a chair, fastened by straps, for this length of time. Man must have the possibility of moving about in the cabin, and consequently its dimensions must be increased and all the conditions necessary for the cosmonauts normal activity must be created.

Special instruments automatically regulating the temperature, humidity, gaseous composition, and pressure of the air must be installed inside the cabin. Another group of instruments must report information concerning flight conditions to the cosmonaut.

During flights over short distances (for example, to the Moon) corrections in the course of the space craft can possibly still be disregarded. But it would be scarcely possible to start a space ship at the precisely determined moment, at the necessary angle, and with the specific velocity needed to direct it toward a goal tens and hundreds of millions of kilometers distant and moving at a speed of 20-30 kilometers per second. Here, says Danilin, a "stellar compass" aimed at a distant star and constantly correcting the ship's path according to a given course must be employed.

The enormous distances and the collosal velocities of interplanetary travel considerably limit the possibilities of man's role as navigator of a space craft. As the cosmonaut must have the possibility of actively engaging in controlling the flight of the space craft it is necessary to develop special instruments which will compensate for human errors.

The difficulty of controlling the space ship is increased by the state of complete weightlessness which immediately replaces the high G-stresses. The best method to counter the effects of weightlessness and to enable the cosmonaut to orient himself easily in space, says Danilin, is to fasten him in the seat at the beginning of the flight. For ensuring the required physical load, rubber tractions in the region of the joints, and special G-suits can be used. Also being studied is the possibility of creating artificial gravitation by rotation of the cabin.

In the matter of ensuring food, water, and air during long flights, the use of biological methods for regenerating the air must be used in addition to devices using chemical matter. Certain algae, for instance chlorella, grows very quickly, increasing its own weight 6 to 7 times in a day, and contains all the substances needed by the human organism.

Recovery is one of the most complex and still not completely solved problems of cosmonautics, says Danilin. In entering the dense layers of the atmosphere, the external shell of the space ship and the air in its sealed cabin will be intensely heated, even if its speed is substantially reduced beforehand. If the craft's speed is 1.5 kilometers per second, its forward sections will be heated up to temperatures exceeding 1,000 degrees. Experiments have shown, says Danilin, that with a humidity of 30 percent, man can remain in a temperature of 100 degrees for 30 minutes, and in a temperature of 200 degrees a total of only 3 minutes.

In addition, says Danilin, it must be kept in mind that while man's sensitivity to temperature fluctuations is sufficently great at lower temperatures, at higher temperatures it drops sharply. As a consequence, temperature control must be effected with instruments independent of man's state of being.

For decreasing the heating of the space ship's hull due to air friction, it may be covered with a refractory ceramic composition. It is necessary to make a type of nose cone which would carry off heat by means of the shock wave arising before it. Another method which could be used is that of transpiration, whereby a liquid is forced through pores in the surface and heat is carried away by evaporation.

During the time the speed of the space ship is being reduced, a man who has for a long time remained in a state of weightlessness, will suddenly be subjected to high G-stresses. To preserve his efficiency, it is necessary to develop a system of descent whereby he could gradually become accustomed to endure the rising G-stresses.

If, says Danilin, the landing is to be made in a capsule, then care must be taken beforehand to ensure that no difficult-to-endure angular accelerations arise. The capsule's parachute must be made to open automatically at a predetermined altitude. The capsule should be buoyant, have a telescoping antenna, and, in case it falls in water, must release a color signal so that it may be easily spotted by search planes.

There are also other means of returning a man to Earth, in which, in particular, the initial reduction of flight speed can be effected by use of jet motors creating a thrust opposite that of the motion of the space craft or of the capsule after separation. Braking parachutes must be used in bringing the speed down to a given value, and after this value has been attained, the main parachute system, which will ensure the smooth descent of the capsule or of the cosmonaut himself in a special space suit, must open. ("Life in the Cosmos," by B. Danilin; Moscow, Nauka i Zhizn', No 7, Jul 59, pp 34-36)

Semenov Discusses Future Space Ships

The space ship of the future, according to Prof V. A. Semenov, will be in the form of a tetrahedral bayonet cut in the middle. The wedge-shaped fuselage will be suspended entirely under the wedge-shaped wings. ("Cosmic Rocket Planes of the Future," by V. A. Semenov; Moscow, Sovetskaya Aviatsiya, 16 Sep 59, p 4)

II. UPPER ATMOSPHERE

New Comet Discovered in Crimea

A report received in the State Astronomical Institute Imeni Shternberg states that A. S. Sharov Candidate of Physicomathematical Sciences, while conducting astronomical observations in Crimea, discovered a new comet of the 12th magnitude. The comet is now in the constellation of Hercules. ("New Comet"; Moscow, Izvestiya, 8 Sep 59, p 2)

III. METEOROLOGY

Direct Measurement of Turbulent Heat Flow in Lower Atmosphere

This article describes a new method and device, consisting primarily of a microanemometer, resistance thermometer, and "correlometer," developed during 1957-1958 in the acoustics laboratory of the Institute of the Physics of the Atmosphere, Academy of Sciences USSR.

The fluctuations of the vertical component of the velocity of the wind are measured with the acoustical microanemometer, the operating principle of which is based on the measurement of the propagation time of a sound wave in air in relation to fixed microphones. The microanemometer has two 2-millimeter sound emitters and two similar microphones. To measure the vertical component of the wind velocity, the emitters and microphones are positioned in the vertical plane 2.5 centimeters apart. An ultrasonic frequency of 75-100 kilocycles is used in the measurements. The value and sign of the vertical component is determined according to the phase shift of the sound wave arriving at the microphones. The sensitivity of the microanemometer is 9 cm/sec . volts, and does not depend on the mean velocity of the wind. The output voltage is linearally dependent on the measured wind velocity; the range of the instrument is plus-minus two meters per second. The microanemometer measures, without distortion, fluctuations of the wind velocity in a range of 0-700 cycles per second. In the transition to wind velocity, intrinsic instrument noise produces a distortion which is not in excess of one centimeter per second. The use of the acoustical circuit eliminates the influence of temperature changes on the measurement of the wind velocity.

The fluctuations of temperature are measured with a pulsed resistance thermometer having a sensing device in the form of a 20-micron platinum wire 20 millimeters long, connected to a bridge circuit. The time constant of the sensing device is on the order of 0.01 second. The maximum sensitivity of the thermometer is 0.15 degree per volt; the amplitude characteristic is linear (for pulsed operation) within plus-minus two degrees. The intrinsic noise of the thermometer produces distortion equal to less than 0.01 degree.

Two voltages obtained at the outputs of the micro-anemometer and resistance thermometer are proportional to the two instantaneous values of the vertical componet of the wind velocity and of the temperature fluctuation. These voltages are fed to two inputs of the "correlometer," an electronic device with an output current proportional, with respect to time, to the average of the two input voltages. This current is measured by an indicator, the dial of which can be calibrated directly into values for turbulent heat flow. ("Direct Measurements of Turbulent Heat Flow in the Surface Layer of the Atmosphere," by V. M. Bovsheverov, A. S. Gurvich and L. R. Tsvang, Institute of the Physics of the Atmosphere, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 125, No 6, 21 Apr 59, pp 1,242-1,245)

Stratification and Latitude Influences on Local Pressure Changes

Empirical data are analyzed with the aid of simplified formulas for the local change of pressure. The results indicate to what extent the individual simplifications influence the quality of a diagnosis and prognosis. An estimation is given of the role of the thermal and nonthermal factors in the local change of pressure at various levels of the atmosphere. The extent to which the values of the vertical velocity and change of surface pressure depend on the stratification of the atmosphere and on latitude is also determined. ("Analysis of the Local Changes of the Absolute Geopotential and of the Pressure at the Earth's Surface," by I. P. Vetlov; Moscow, Trudy Tsentral'nogo Instituta Prognozov, No 70, 1958, pp 13-54)

IV. SEISMOLOGY

New Seismic Stations in Siberia and Far East Planned

The Presidium of the Academy of Sciences USSR approved a plan for the construction of new seismic stations in the territory of Siberia and the Far East from 1959-1965, introduced by the Siberian Division of the Academy of Sciences USSR and sanctioned by the Council on Seismology.

Two general type and 7 regional type stations will be built in the Altay-Tubinskiy zone, 2 general type and 10 regional type in the Baykal zone, 8 regional type stations in Yakutsk, and 5 general type and 3 regional type stations in the Far East. ("Construction of New Seismic Stations"; Moscow, Vestnik Akademii Nauk SSSR, No 8, Aug 59, p 75)

V. GRAVIMETRY

Gravitational Anomalies Caused by Finite Cylindrical Bodies

Although direct methods of interpreting gravitational anomalies caused by both two-dimensional and three-dimensional bodies are well known, those caused by three-dimensional bodies are often interpreted without sufficient justification, as if they were caused by two-dimensional bodies. It is extremely difficult to determine the limits of applicability of such approximations, and the arbitrary use of the assumption of the infiniteness of the space occupied by the objects studied may lead to considerable errors.

This article investigates the size of these errors and possible ways of computing them to increase the validity of such interpretation. The solution of the problem involves a consideration of the gravitational effect caused by a finite cylindrical body of arbitrary cross section, extended by generatrices parallel to the earth's surface. The mathematical treatment, based on the expression for the profile extending through the center of the body perpendicular to its extension, involves two derivatives of the gravitational potential, two coordinate points of the rotating body, the cross-sectional area of the body, the gravitation constant, the excess or defect of density, and the moving coordinate which determines the position of the object on the line under consideration. ("Interpretation of Gravitational Anomalies Caused by Finite Cylindrical Bodies," by K. F. Tyapkin, Dnepropetrovsk Mining Institute; Moscow, Doklady Akademii Nauk SSSR, Vol 125, No 6, 21 Apr 59, pp 1,249-1,251)

VI. OCEANOGRAPHY

Zarya in Red Sea

The non-magnetic ship Zarya is now sailing in the Red Sea according to a report from B. Bologov, chief of the Complex Marine Magnetic Expedition. The ship will lay over in Aden for a day to take on water and fuel. ("The Zarya Radios...," by B. Bogolov; Moscow, Izvestiya, 8 Sep 59, p 1)

VII. GLACIOLOGY

Exploration of Fedchenko Glacier Described

The study of the Fedchenko Glacier, located in the Pamirs, was begun in June 1957. In the 2 years which have passed a great deal of information on the glacier, the regime of its rivers, and its climatic characteristics

has been gathered. Some of the results, as reported by V. Suslov, deputy chief of the expedition of the Academy of Sciences Uzbek SSR, on Fedchenko Glacier are summarized below.

The Fedchenko Glacier is a gigantic storehouse of water power. The massive ice mass contains 500 cubic kilometers of ice, rises to an altitude from 4,000 to 5,000 meters, and feeds many Asiatic streams.

The glacier fields in the Pamirs are a unique "weather kitchen." Here, the weather which affects the climate and hydrological regime of the neighboring regions is made. The object of the expedition was to find the answer to many problems in this connection by studying the life of the region's high mountain glaciers. This meant it was necessary, first of all, to conduct a detailed study of changes in the dimensions and the structure of the glaciers and snow fields, to know the temperature regime of the ice, the conditions of the accumulation-ablation balance and peculiarities of the discharge of melt waters, and to explain the size of glaciers and their geological activity.

In addition to the glacier station "Lednik Fedchenko," operating since 1932, two new stations were built during the IGY. One of these, "Lednik Vitkovskiy," was established at the 5,020 meter level in the zone of constant minus temperatures. The selection of this location was dictated by the need for information on the regions where the greatest accumulation of precipitation occurred. Here, it was felt, also lay the key to the relation between changes in the glacier and climatic fluctuations.

Systematic observations of the heat balance on the glacier surface were conducted for this purpose and the conditions of the accumulation of precipitations and their conversion into firn and ice were studied.

The second scientific station was organized at an altitude of about 3,000 meters. Its duties consisted mainly of meteorological and glaciological observations. Glaciological observations were conducted simultaneously also by a mobile detachment of the expedition.

Work at the upper station, Lednik Vitkovskiy, which was situated in the open in the center of a firn field, was hampered by winds which at times reached a force of 170 kilometers per hour, carrying away scientific instruments, meteorological booths, and masts, and by the extreme low temperatures which at times dropped to -30 and -35 degrees Centigrade.

Studies of the firn fields revealed that 15-20 times more precipitation falls on the Fedchenko glacier than in neighboring regions of the eastern Pamirs. During a year, 1,350 millimeters of precipitation was recorded at Lenik Vitkovskiy while a total of 60-70 millimeters was noted on Lake Kara-Kul'. It was also discovered that the prevailing southwest and south winds,

encountering obstacles in their way, sweep the bulk of the snow into the upper parts of the mountains framing the glacier. The amount of precipitation decreases noticeably according to the distance from the sources of the glacier. The gradient of change in precipitation with altitude is given as 38 millimeters for each 100 meters of elevation from the snow line up to the top of the glacier.

The mean-monthly speed of the ice was fixed at 15 meters in the region of the upper station and at about 10-12 meters at the top of the glacier.

Several rather large glaciers were discovered during the exploration of the top of the Redchenko Glacier.

In the pass between the Fedchenko Glacier basin and the basin of the Grum-Grzhimaylo Glacier, a branch of the Lednika Fedchenko station is now in operation at an altitude of 6,000 meters. This is the highest station of this sort in the world. It is manned by two scientists who conduct continuous, 24-hour observations.

Several thousand observations were conducted by the associates of the lower glacier station. Here, conditions of the discharge of melted glacier waters, the temperature of the deep layers and the dynamics of the ice, solar radiation, and other phenomena are carefully investigated.

Seismic methods of prospecting were used for the first time on the Fedchenko Glacier. They confirmed that the thickness of the ice in the center portion of the glacier exceeds 800 meters.

Comparing the data obtained with the results of similar observations conducted in previous years, it was determined that glaciers in the Pamir are gradually shrinking and retreating.

This phenomenon coincides with a general period of reduction in continental and mountain glaciation for the entire Earth.

The observations on Fedchenko are being continued. ("At an Altitude of 5,000 Meters," by V. Suslov; Moscow, Nauka i Zhizn', No 8, Aug 59, pp 26-30)

Severnyy Polyus-6 To Be Discontinued

The ice floe of the drift station Severnyy Polyus-6 is now located about 300 kilometers northwest of Spitsbergen and 350 kilometers from the northeast tip of Greenland. According to estimates of scientists in the Arctic and Antarctic Institute, the further drift of Severnyy Polyus-6 should continue southward, and the ice floe is thus expected to enter the Greenland Sea. For this reason, it has been decided to remove the station staff from the ice floe.

It is assumed that Severnyy Polyus-6 will be located 1,000-1,100 kilometers west of Zemlya Frantsa Iosifa by early October. From this point, Polar Aviation airplanes will undertake the pickup operation. ("To the Mainland," Moscow, Izvestiya, 30 Aug 59)

Changes in Arctic Climate

The newspaper Komsomol'skaya Pravda requested the opinions of several scientists, including L. A. Chubukov, Doctor of Geographical Sciences; V. R. Dmitsov, head of one of the divisions of the Central Bureau of Weather Forecasts, and others, regarding recent changes in the climate.

According to meteorological observations, a certain warming of the climate is taking place at this time. Numerous facts have proved this. During the past 100 years, the average yearly temperature in Leningrad has risen by more than one degree, which corresponds to the whole city being moved 600-700 kilometers to the south. The warming trend is especially noticeable in the Arctic, where islands of frozen soil and ice are melting. Ostrov Vasil'yevskiy has melted and only an underwater bank has appeared in its place. Ostrov Semenovskiy previously had a length of 15 kilometers; now it is only one kilometer long. Lyakhovskiye Ostrova are melting like sugar in a glass of water. Glaciers are rapidly retreating everywhere. French scientists have claimed that the glaciers in Greenland are decreasing by 100 cubic meters per year.

On the basis of current data, one cannot speak of any abrupt changes in climate. The warming process is not consistent throughout. For example, in North America the glaciers retreated up to 1943, while they are now once more increasing. The general rate of temperature increase has slowed down since 1940.

There are various opinions among scientists as to the reason for the present warming trend. Some specialists in the West maintain that the warmer weather is caused by the increase of carbon dioxide in the atmosphere, others ascribe it to nuclear and thermonuclear explosions, and still others, to the concentration of meteorite dust in the vicinity of our planet.

However, according to observations during the IGY, the present warming trend is caused mainly by fluctuations in solar activity. A connection has been established between the widespread occurrence of sun spots and many unusual weather phenomena. A further processing of observations conducted during the IGY will undoubtedly provide more detailed information regarding the sun's influence on the climate.

In answer to the question whether man is able to control the forces of nature which influence weather and climate, one may safely say: yes, it is possible. By planting forest belts, building numerous ponds and reservoirs, creating new seas and canals, man changes the conditions of surface draining, and the wind, humidity, and temperature regime of the lower atmosphere.

The present stage of development of science and technology makes it possible, in principle, to change the climate of a large area. A. I. Shumilin, a Soviet engineer, came up with the idea of building an 85-kilometer long dam-bridge across the Bering Strait, equipped with powerful pumps and an atomic electric power station for pumping 100,000 cubic kilometers of warm water out of the Pacific into the Arctic Ocean. This would moderate the climate of the Arctic and its adjoining continents, would eliminate permafrost and put an end to conditions causing the formation of huge masses of cold Arctic air.

Another interesting idea for changing the climate of the Arctic by melting the floating ice was presented by the Soviet scientist G. A. Avsyuk in 1958 at the International Conference for the Study of Sea Ice. Until recently, it was assumed that the annual heat balance in the Central Arctic was negative. The observations conducted at drift stations have refuted this theory, proving that the heat balance is positive. Therefore, the ice in the Arctic exists, as it were, through inertia, as a result of the fact that it was formed a long time ago and has a high reflective power. If the ice should now be destroyed, it would not be formed again under present conditions.

It would be technically possible to destroy the ice in vast areas of the Arctic seas by reducing its reflective power. This could be done by spreading it with a layer of some dark substance, as for example ash. The disappearance of permanent ice from the Arctic seas would lead to a great change in the climate on the adjoining mainland, i.e., in Siberia and northern Canada. The climate in these regions would become milder and more humid, and conditions for vegetation would improve. However, for the time being all this is just a formulation of the problem. The important point is that men are now trying out the weapons which will enable them at some time in the future to attempt changing the climate in the required direction. ("A New Ice Age?" Moscow, Komsomol'skaya Pravda, 26 Jul 59)

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